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Energy Efficiency and Renewable Energy Portfolios

2019 Annual Evaluation Report
(Volume I – Executive Summary)

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1. Introduction

This report presents the results of the program evaluation that the Opinion Dynamics evaluation team conducted for PSEG Long Island's 2019 Energy Efficiency and Renewable Energy Portfolios. The Energy Efficiency and Renewable Energy Portfolios are administered by PSEG Long Island and its subcontractor, TRC, on behalf of the Long Island Power Authority (LIPA). This evaluation covers the period from January 1, 2019, to December 31, 2019.

The Opinion Dynamics evaluation team produced two volumes that together compose the entire Annual Evaluation Report. This document, the 2019 Annual Evaluation Report (Volume I), provides an overview of evaluation findings, including impact and process results for 2019. The 2019 Program Guidance Document (Volume II) provides detailed program-by-program impact analysis results, process evaluation findings, and a discussion of data collection and analytic methods. The evaluation team developed the Program Guidance Document with the needs of PSEG Long Island's and TRC's program planners and managers in mind, as the programs in the Energy Efficiency and the Renewable Energy Portfolios continue to be important and cost-effective resources. In addition to the Annual Evaluation Report, each year in late January, the evaluation team calculates verified ex ante (VEA) savings for the Energy Efficiency and Renewable Energy Portfolios, which PSEG Long Island and LIPA use to assess the performance of the programs in relation to the annual savings goals. The memorandum reporting the 2019 verified ex ante savings is provided as an appendix to Volume II of the report. For definitions of the energy efficiency terms and acronyms included in the report, please refer to the Glossary of Terms in Appendix A.

1.1 Key Definitions

Below we provide definitions for key terms used throughout this document.

- **Gross Impacts:** The change in energy consumption or demand that results directly from program-related actions taken by participants, regardless of why they participated. These impacts include coincidence factors (CFs) for demand, waste-heat factors, and installation rates. Gross impacts presented in this report do not include line losses and, therefore, represent the energy and demand savings as would be measured at the customers' meters.
- **Net Impacts:** The change in energy consumption or demand that results directly from program-related actions taken by customers (both program participants and non-participants) that would not have occurred absent the program. The difference between the gross and net impacts is the application of the net-to-gross ratio (NTGR). Net impacts presented in this report also include line losses and, therefore, represent the energy and demand savings as would be measured at the generator.
- **Net-to-Gross Ratio (Free-Ridership and Spillover):** The factor that, when multiplied by the gross impacts, provides the net impacts for a program. The NTGR is defined as the savings that can be attributed to programmatic activity and is composed of free-ridership (FR) and spillover (SO). FR reduces the ratio to account for those customers who would have installed an energy-efficient measure without a program. The FR component of the NTGR can be viewed as a measure of naturally occurring energy efficiency, which may include efficiency gains associated with market transformation resulting from ongoing program efforts. SO increases the NTGR to account for those customers who install energy-efficient measures outside of the program (i.e., without an incentive)

but due to the actions of the program. The NTGR is generally expressed as a decimal and quantified through the following equation:

$$\text{NTGR} = 1 - \text{FR} + \text{SO}$$

- **Ex Ante Gross Savings:** The energy and demand savings expected by the program as found in the program tracking database.
- **Verified Ex Ante Gross Savings:** The energy and demand savings calculated by the evaluation team using methods and assumptions consistent with those used by PSEG Long Island to develop annual savings goals. These savings estimates are used to determine if PSEG Long Island achieves its annual scorecard goals.
- **Ex Post Net Savings:** The savings realized by the program after independent evaluation determines ex post gross savings and applies NTGRs developed by the evaluation team. Ex post net savings also include line losses. The evaluation team uses the ex post net impacts in the cost-effectiveness calculation to reflect the current best industry practices.
- **Line Loss Factors:** The evaluation team applies line losses of 6.0% on energy consumption (resulting in a multiplier of $1.0638 = [1 \div (1 - 0.060)]$) and of 8.5% on peak demand (resulting in a multiplier of $1.0929 = [1 \div (1 - 0.085)]$) to estimate energy and demand savings at the power plant.
- **kW (Demand or Capacity):** The average level of power used for an hour. Peak demand is the average power used across a four-hour period when there is high use. For Long Island, peak demand may take place anytime from 2 pm to 6 pm, Monday through Friday (non-holiday), from June to August. System coincident demand is the level of demand at the hour of the day when there is the maximum demand on the system grid. Demand savings values in this report are based on system coincident demand impacts between 4 pm and 5 pm on non-holiday weekdays from June to August.
- **kWh (Energy Consumption):** The total power consumed over the course of an hour. Energy impacts are based on annual consumption.
- **Societal Cost Test (SCT):** A test that measures the net costs of an energy efficiency program as a resource option based on the total costs of the program, including both the participants' and the program administrator's costs. Rebate costs are not included in this test because they are assumed to be a societal transfer. To maintain consistency with the most current version of the New York Benefit-Cost Analysis Handbook, we applied the SCT as a primary method of determining cost-effectiveness using the same assumptions as those used by PSEG Long Island's resource planning team.
- **Utility Cost Test (UCT):** A test that measures the net costs of an energy efficiency program as a resource option, based on the costs that the program administrator incurs (including incentive costs) and excluding any net costs incurred by the participant. To allow for direct comparison with PSEG Long Island's assessment of all supply-side options, and consistent with previous evaluation reports, we continue to show the UCT as a secondary method of determining cost-effectiveness.
- **Discount Rate:** The interest rate used to calculate the present value of future payments (i.e., the avoided costs from energy and demand savings). PSEG Long Island uses a weighted average cost of capital supplied by LIPA that represents the cost of borrowing to build additional capacity to meet the future supply needs of the service territory. Based on these factors, we used a nominal discount rate of 6.16% in the 2019 evaluation.
- **Levelized Cost of Capacity:** The equivalent cost of capacity (kW) to be incurred each year over the life of the equipment that would yield the same present value of total costs, using a nominal discount

rate of 6.16% to be consistent with base load generation supply-side resources in the Long Island service territory. The levelized cost of capacity is a measure of the program administrator's program costs in a form that can be compared to the cost of supply additions.

- **Levelized Cost of Energy:** The equivalent cost of energy (kWh) over the life of the equipment that would yield the same present value of costs, using a nominal discount rate of 6.16%. The levelized cost of energy is a measure of the program administrator's program costs in a form that can be compared to the cost of supply additions.

2. Executive Summary

In 2019, PSEG Long Island spent approximately \$81 million implementing the Energy Efficiency and Renewable Energy Portfolios, which was about \$6 million more than was spent in 2018. The 2019 ex post energy and demand savings from these portfolios exceeded established energy savings goals by 13% and 10%, respectively. Several key factors were important to the overall 2019 portfolio performance in terms of savings compared to goals, as well as for the programs' future success, as described below.

- **The Energy Efficient Products program greatly exceeded its goals.** In 2019, the Energy Efficient Products (EEP) program exceeded its energy savings goals by more than 42,000 MWh (ex post energy savings 132% of goal), more than making up for shortfalls in several other efficiency programs. Also, as has been the case in prior years, savings from lighting measures, which make up the vast majority of EEP program savings, primarily drove the program's and the portfolio's performance. In particular, the EEP program was able to rebate more than 2 million standard A-line LEDs in 2019 compared to a plan of 1 million.
- **The Home Energy Management program fell short of its goal.** The Home Energy Management (HEM) program realized 76% of its energy savings goal, which was about 10,000 MWh short of the goal. The HEM program's savings were nearly half that realized in 2018. Overall, the percent savings on a per household level decreased from 1.06% in 2018 to 0.7% in 2019. While these per household savings are in the range of similar programs in other jurisdictions (including elsewhere in New York), the reduction in savings compared to 2018 could be due to a variety of factors, including imperfect frequency and timing of the home energy reports participants received in 2019 due to fewer actual meter reads for a significant portion of participants as meter reading routes were altered.
- **The Energy Efficiency Portfolio continues to diversify.** With the lighting market's rapid transition to energy efficiency, program administrators are working on structuring their energy-efficient portfolios to be less dependent on lighting measures for energy savings. While lighting continues to account for the largest share of savings by end use, PSEG Long Island made further progress toward diversifying the sources of energy savings in its Energy Efficiency Portfolio in 2019. PSEG Long Island continues to identify new measures (e.g., ENERGY STAR freezers and bathroom ventilation fans) and emphasized other non-lighting measures (e.g., commercial refrigeration measures, cold climate air source heat pumps) within its existing programs. For the Commercial Efficiency program (CEP), lighting now accounts for 76% of energy savings, down from 94% in 2016, due to the program placing a greater emphasis on refrigeration, custom non-lighting, and combined heat and power (CHP) measures. For the EEP program, however, lighting still accounts for a very large share (92%) of energy savings. Driven by the Energy Independence and Security Act (EISA) and other market forces, savings opportunities from residential lighting are generally declining. Recognizing these market changes, PSEG Long Island anticipated 2019 being the last year it would provide upstream rebates for standard LEDs. However, recent rollbacks in the EISA rules and their enforcement have prompted many program administrators in New York and throughout the U.S., including PSEG Long Island, to consider continuing rebates for standard LEDs in 2020 and 2021.
- **The Home Comfort program exceeded its goals and continues to successfully transform from the cooling savings emphasis of the Cool Homes program to a heating and cooling program focus.** In preparation for the New Efficiency: New York beneficial electrification targets, in 2019 the Home Comfort program laid the groundwork to achieve MMBtu savings from the displacement of fossil fuels in addition to electric savings, beginning in 2020. While deemphasizing cooling-only measures in 2019, the Home Comfort program was able to achieve ex post energy savings of 131% of its goal. In addition, PSEG Long Island offered three pilot offerings in 2019 aimed at three key market

segments crucial for the widespread adoption of heat pumps. Understanding that the Home Comfort program will be the principal means for PSEG Long Island to achieve its beneficial electrification energy savings targets going forward, PSEG Long Island is proactively working to understand and address the significant market barriers to heat pump adoption, which will be critical to the program's success.

2.1 Summary of Portfolio Performance

The 2019 annual demand and energy savings goals were 280,596 MWh and 60.38 MW for the combined Energy Efficiency and Renewable Energy Portfolios, as shown in Table 1. The verified ex ante savings, which are used for comparing savings to the annual scorecard goals, are 122% of the goal for energy and 114% of the goal for demand. Ex post energy and demand savings are 113% and 110% of the goals, respectively. PSEG Long Island achieved these savings at a total cost of approximately \$81 million, just under its budget.

Table 1. Gross Impacts: Energy Efficiency and Renewable Energy Portfolios – Ex Post Impacts versus Goals

Program	PSEG Long Island Annual Energy Efficiency and Renewable Energy Budget	Energy Efficiency and Renewable Energy Actual Cost	Energy Savings (MWh)			Coincident Demand Savings (MW)		
			Goal	Verified Ex Ante	Ex Post	Goal	Verified Ex Ante	Ex Post
Energy Efficiency Portfolio								
Commercial Efficiency Program (CEP)	\$39,863,627.63	\$35,380,455.83	95,953	97,743	94,983	19.78	17.81	17.65
Residential Efficiency Programs								
Energy Efficient Products	\$20,104,610.43	\$21,695,268.84	130,599	159,809	172,583	34.08	42.95	42.05
Home Comfort	\$4,058,313.62	\$4,271,156.40	2,728	3,472	3,578	1.81	1.17	1.02
Residential Energy Affordability Partnership (REAP)	\$2,390,858.68	\$2,414,621.98	1,472	1,472	1,219	0.32	0.36	0.29
Home Performance	\$10,449,215.72	\$11,585,546.40	2,761	2,300	2,743	2.19	1.65	0.96
Home Energy Management (HEM)	\$3,859,601.00	\$3,322,058.18	41,487	64,015	31,405	NA	N/A	NA
Subtotal Residential	\$40,862,599.44	\$43,288,651.80	179,047	231,068	211,528	38.40	46.13	44.32
Total Energy Efficiency Portfolio (Commercial and Residential)	\$80,726,227.08	\$78,669,107.63	275,000	328,811	306,511	58.18	63.94	61.96
Renewable Energy Portfolio	\$637,221.74	\$2,346,943.18	5,596	12,814	11,825	2.20	5.05	4.72
Total Energy Efficiency and Renewable Energy Portfolios	\$81,363,448.82	\$81,016,050.81	280,596	341,625	318,336	60.38	68.99	66.69

Notes:

1. Costs and budget figures do not include line items not associated directly with the Energy Efficiency or Renewable Energy Portfolios, including LIPAEEdge, Reforming the Energy Vision (REV), or Utility 2.0.
2. Actual costs are the expenditures necessary to obtain the energy and demand savings reported in the TRC Captures systems, and do not reflect PSEG Long Island accrual accounting.
3. Renewable Energy Portfolio impacts are expressed in terms of generation.
4. Solar PV benefits and costs (which are included in the Renewable Energy Portfolio) includes \$1.3 million of rebates from NYSERDA.

PSEG Long Island tracks its performance against annual energy savings goals, which it derives from planning assumptions regarding key inputs to the estimation of expected gross and net savings. To allow for consistency and direct comparison between evaluated program performance and established savings goals, the evaluation team developed "verified ex ante savings" estimates for each Energy Efficiency and Renewable Energy program. This comparison verifies that the methods and assumptions used by PSEG Long Island to develop their annual plan for program savings were applied consistently throughout the year in developing the ex ante savings. The verified ex ante savings are used as a comparison to the established annual savings goals.

In 2019, PSEG Long Island's savings goals shifted from net savings at the generator to gross savings at the customer's meter to be in alignment with the targets established by the New Efficiency: New York December 2018 Order.¹ As such, PSEG Long Island began tracking its program savings in terms of gross energy and demand savings without line losses in 2019, and this evaluation applies the same metrics in establishing realization rates and when comparing ex post savings to ex ante and program goals.

For the purposes of benefit/cost assessments, however, savings are calculated in terms of net savings at the generator. The best-practice approach to this assessment dictates that the net savings used to develop the benefit/cost ratio take into consideration current levels of naturally occurring energy efficiency, FR, and SO to provide an estimate of the benefits associated with the current year's investment in the programs. Therefore, the evaluation team applied net-to-gross factors derived from primary data collection with customers, when possible, to develop the net energy savings estimates included in the benefit/cost ratio calculation and for lifetime levelized costs.

2.1.1 Cost-Effectiveness Results

Based on our analysis of portfolio impacts and costs, the savings generated by the Energy Efficiency and Renewable Energy portfolios are cost-effective. As shown in Table 2:

- Based on the UCT, the overall benefit/cost ratio is 2.14 for the combined portfolio savings (a UCT value greater than 1 indicates that portfolio benefits outweigh costs), and the levelized costs of the combined portfolio savings are \$144.84/kW-yr or \$0.03/kWh.²
- Based on the SCT, the overall benefit/cost ratio is 1.92 for the combined portfolio savings and the levelized costs are \$234.37/kW-yr or \$0.05/kWh.

¹ Case 18-M-0084, In the Matter of a Comprehensive Energy Efficiency Initiative, Order Adopting Accelerated Energy Efficiency Targets (issued December 13, 2018).

² A levelized cost analysis is a way to quickly compare the cost of energy efficiency programs with energy or demand savings from other sources. Because levelized costs are expressed as \$/kW-yr and/or \$/kWh, they can be readily compared to the cost of alternative supply additions or the cost of generating electricity.

Table 2. Energy Efficiency and Renewable Energy Portfolios Benefit/Cost Ratio and Levelized Costs

Program	Benefit/Cost Ratio		UCT Levelized Costs		SCT Levelized Costs	
	UCT	SCT	\$/kW-yr	\$/kWh	\$/kW-yr	\$/kWh
Energy Efficiency Portfolio						
Commercial Efficiency Program	1.71	1.91	\$219.69	\$0.04	\$288.62	\$0.05
Residential Efficiency Programs						
Energy Efficient Products	4.07	3.73	\$71.40	\$0.02	\$112.16	\$0.03
Home Comfort	0.87	1.09	288.20	\$0.09	\$320.81	\$0.10
Residential Energy Affordability Partnership (REAP)	0.43	0.66	\$702.03	\$0.17	\$702.03	\$0.17
Home Performance	0.21	0.54	\$1,067.87	\$0.39	\$855.73	\$0.31
Home Energy Management	0.43	0.69	-	\$0.10	-	\$0.10
Subtotal Residential	2.25	2.62	\$130.01	\$0.03	\$161.75	\$0.04
Total Energy Efficiency Portfolio (Commercial and Residential)	2.01	2.29	\$159.24	\$0.03	\$203.11	\$0.04
Renewable Energy Portfolio	6.48	0.68	\$35.93	\$0.01	\$470.76	\$0.18
Total Energy Efficiency and Renewable Energy Portfolios	2.14	1.92	\$144.84	\$0.03	\$234.37	\$0.05

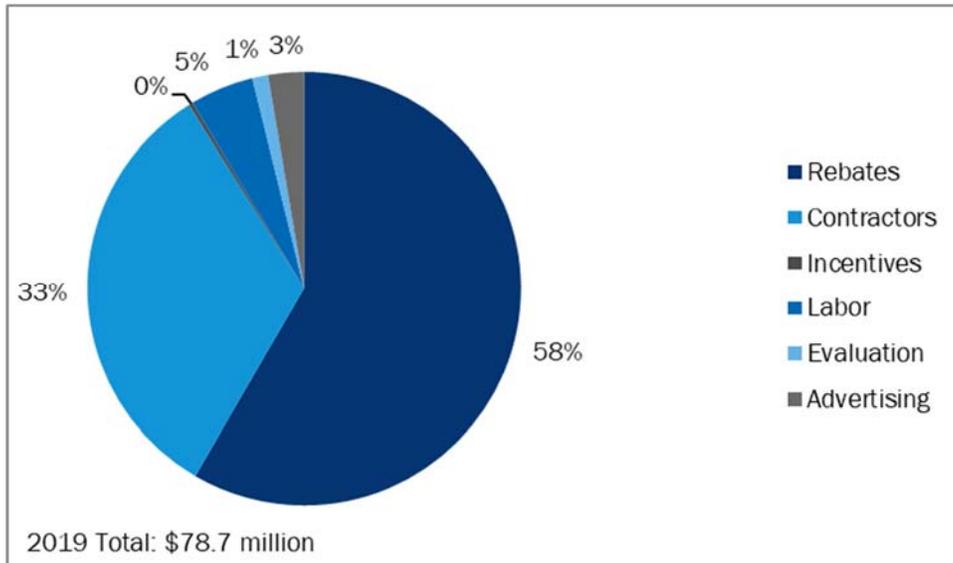
Notes:

- Benefit/cost ratio from Utility Cost perspective using comparison to base load marginal supply costs. If ratio is greater than 1.0, program is cost-effective.
- UCT does not consider lost revenues or net metering subsidies.
- SCT includes a non-energy benefit “adder” of 15% for market rate programs and 30% for income-qualified programs (REAP). The “adder” is applied to the electric avoided costs generated through each program and is consistent with the approach used by PSEG Long Island in its 2019 program planning.
- All levelized cost calculations use a discount rate of 6.11% to be consistent with supply-side alternatives.

2.1.2 2019 Expenditure Summary

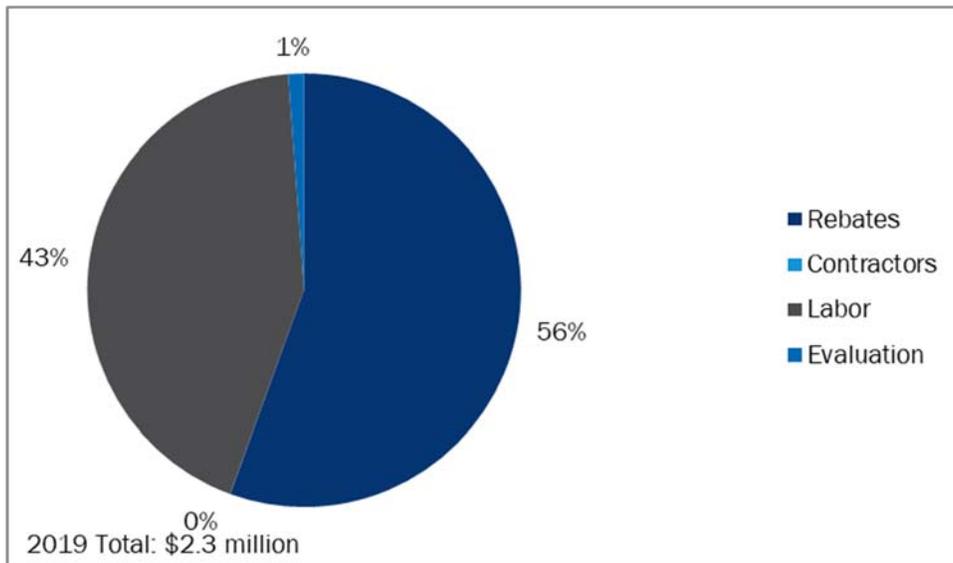
PSEG Long Island spent \$81 million on the Energy Efficiency and Renewable Energy Portfolios in 2019, compared to \$74.7 million in 2018. Figure 1 presents a summary of the \$78.7 million spending related to implementation, management, and evaluation of energy efficiency programs in the 2019 Energy Efficiency Portfolio by type of expenditure. Figure 2 provides the detail for the \$2.3 million investment in the 2019 Renewable Energy Portfolio.

Figure 1. 2019 PSEG Long Island Expenditures for the Energy Efficiency Portfolio



"Rebates" consists of payments made to participating customers. "Incentives" consists of payments made to participating contractors (e.g., heating, ventilation, and air conditioning (HVAC) installers).

Figure 2. 2019 PSEG Long Island Expenditures for the Renewable Energy Portfolio

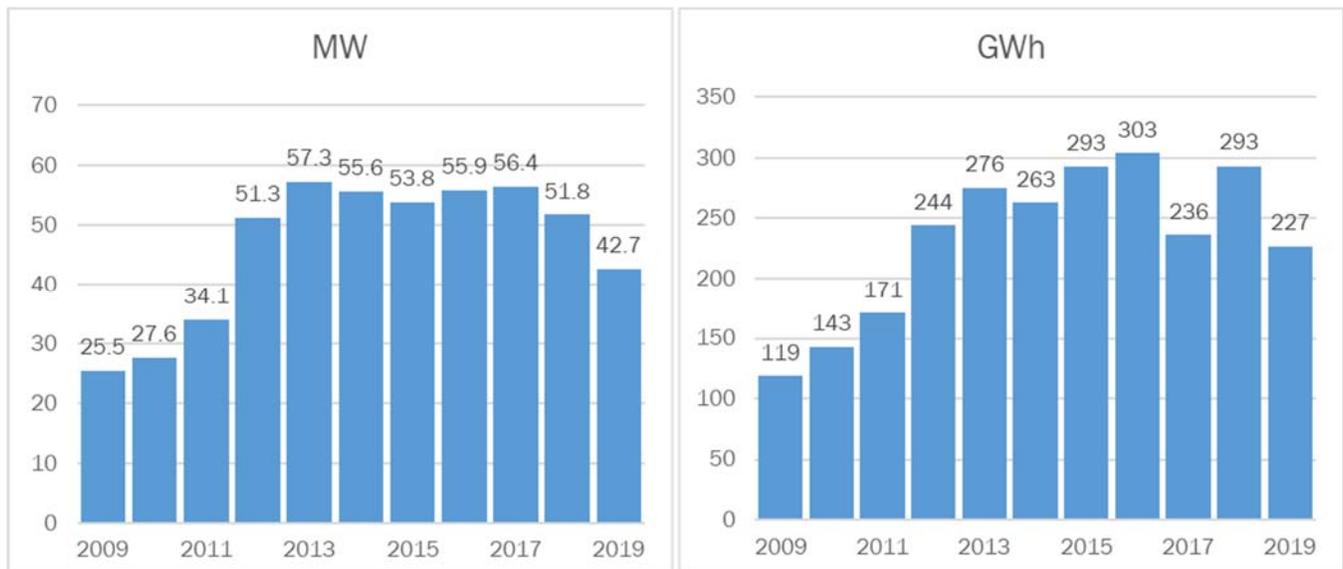


"Rebates" consists of payments made to participating customers.

2.2 Energy Efficiency Portfolio Evaluated Impacts

Overall, ex post gross savings from the Energy Efficiency Portfolio included 306,511 MWh of energy savings and 61.96 MW of demand savings. These energy savings resulted in the annual displacement of more than 181,491 tons of carbon dioxide equivalents,³ 35.86 tons of sulfur dioxide, and 131.8 tons of nitrogen oxides. These greenhouse gas reductions are equivalent to removing more than 35,571 cars from the road and a fuel savings of more than 381,190 barrels of oil.⁴ Figure 3 presents the evaluated net savings from the energy efficiency programs spanning the 11 years since the Energy Efficiency Portfolio's inception (2019 savings shown here are net savings with line losses to be consistent with prior years).

Figure 3. 2019 Energy Efficiency Portfolio Evaluated Net MW and GWh Savings



As discussed in Section 1, PSEG Long Island uses verified ex ante gross savings estimates as one metric to track program performance against annual goals. According to this metric, in 2019 the Energy Efficiency Portfolio surpassed its energy savings goal by 20% and its demand savings goal by 10%. Ex post savings results for the Energy Efficiency Portfolio were similar to the verified ex ante results, with ex post energy savings exceeding the goal by 11% and ex post demand savings exceeding the goal by 7%.

As in prior years, there are variances between ex post results and the established savings goals across programs. While the CEP, Home Performance, REAP, and HEM programs' ex post energy savings all fell short of their 2019 goals, the performance of the EEP and Home Comfort programs significantly exceeded their energy savings goals, which more than made up for the shortfalls.

³ Carbon dioxide equivalents includes carbon dioxide, methane, and nitrous oxide.

⁴ Displacement savings values calculated using 2018 Long Island sub-regional emissions rates of the U.S. Environmental Protection Agency's (EPA's) Emissions & Generation Resource Integrated Database (eGRID 2018v2), released January 28, 2020. Equivalent savings values are based on the U.S. EPA's Greenhouse Gas Equivalencies Calculator (updated March 2020).

2.3 Energy Efficiency Portfolio Economic Impacts

As part of the annual evaluation, Opinion Dynamics assessed the economic impacts of the Energy Efficiency Portfolio investments on the economy of Long Island. Beginning in 2011, we developed an input-output (I-O) model of the Long Island regional economy using IMPLAN modeling software to estimate these impacts. Central to the I-O model approach is the development of a static model for the effects of program spending based on a matrix of relationships among economic sectors, including industries, households, government, and foreign trade. The model requires inputs on spending, avoided costs, electric rates, and other parameters from PSEG Long Island, and draws on the net savings information included in the benefit/cost assessment. The evaluation team updated this model and its inputs for this 2019 evaluation.

As in previous years, we estimated 1-year and 10-year economic impacts associated with the 2019 Energy Efficiency Portfolio investment, where the 10-year economic impacts accrue from measures installed in 2019 over the first ten years of their effective useful life. We then add these 1-year and 10-year economic impacts to the 2009–2018 estimates to develop a portfolio-to-date estimate (adjusted to 2019 dollars).⁵

As shown in Table 3, our analysis of economic benefits found that PSEG Long Island’s \$78.7 million investment in the Energy Efficiency Portfolio in 2019 returned an additional \$75.6 million in total economic benefits to the Long Island regional economy in 2019, including 523 full-time equivalent (FTE) employees.⁶ Over 10 years, these 2019 investments are expected to return \$142.8 million in total economic benefits to the regional economy (in 2019 dollars⁷), with an employment benefit of 1,056 new FTEs.

Extrapolating these results over the 11-year life of the portfolio, the \$700.7 million invested to date in Energy Efficiency (\$917.4 million in 2019 dollars) produced approximately \$1.02 billion⁸ in cumulative annual economic benefits, with an employment benefit of 5,443 FTE employees. Over the 10 years following each program year investment, these 11 years of investments are expected to return \$2.15 billion⁹ to the Long Island regional economy and result in 11,974 additional FTEs between 2009 and 2028.

Table 3. Economic Impact of 2009–2018 Energy Efficiency Portfolio Investments

Effect	Impact of 2019 Program Investment		Impact of 2009-2019 Program Investment	
	First-Year Impact	Impact over 10 Years ^a	First-Year Impact	Impact over 10 Years ^a
Total Economic Output (2019 \$1M) ^b	\$75.6	\$142.8	\$1,020.9	\$2,145.5
FTE Employees	523	1,056	5,443	11,974

^a Includes the 10-year impacts for each program year beginning in that year.

^b Total economic output is the value of industry production. In IMPLAN, these are annual production estimates in producer prices.

⁵ Opinion Dynamics estimated the economic impact of the portfolio for the first 2 years of Energy Efficiency Portfolio implementation by extrapolating the economic impacts from 2011 (assuming similar multipliers of economic impact) to arrive at a portfolio-to-date estimate.

⁶ FTEs represent the number of total hours worked divided by the number of compensable hours in a full-time schedule. This unit allows for comparison of workloads across various contexts. An FTE of 1.0 means that the workload is equivalent to a full-time employee for 1 year, but could be done, for example, by one person working full-time for a year, two people both working half-time for the year, or two people both working full-time for 6 months.

⁷ Using the energy supply discount rate assumption of 6.11%.

⁸ In 2019 dollars.

⁹ In 2019 dollars.

2.4 Renewable Energy Portfolio Evaluated Impacts

Overall, evaluated gross savings from the Renewable Energy Portfolio included 11,825 MWh of energy savings and 4.72 MW of demand savings. These energy savings resulted in the annual displacement of more than 7,002 tons of carbon dioxide equivalents,¹⁰ 1.38 tons of sulfur dioxide, and 5.08 tons of nitrogen oxides. These greenhouse gas reductions are equivalent to removing more than 1,372 cars from the road and a fuel savings of more than 14,706 barrels of oil.¹¹ Figure 4 presents the evaluated net savings from the renewable energy programs spanning the 11 years since the Renewable Energy Portfolio's inception (2019 savings shown here are net savings with line losses to be consistent with prior years).

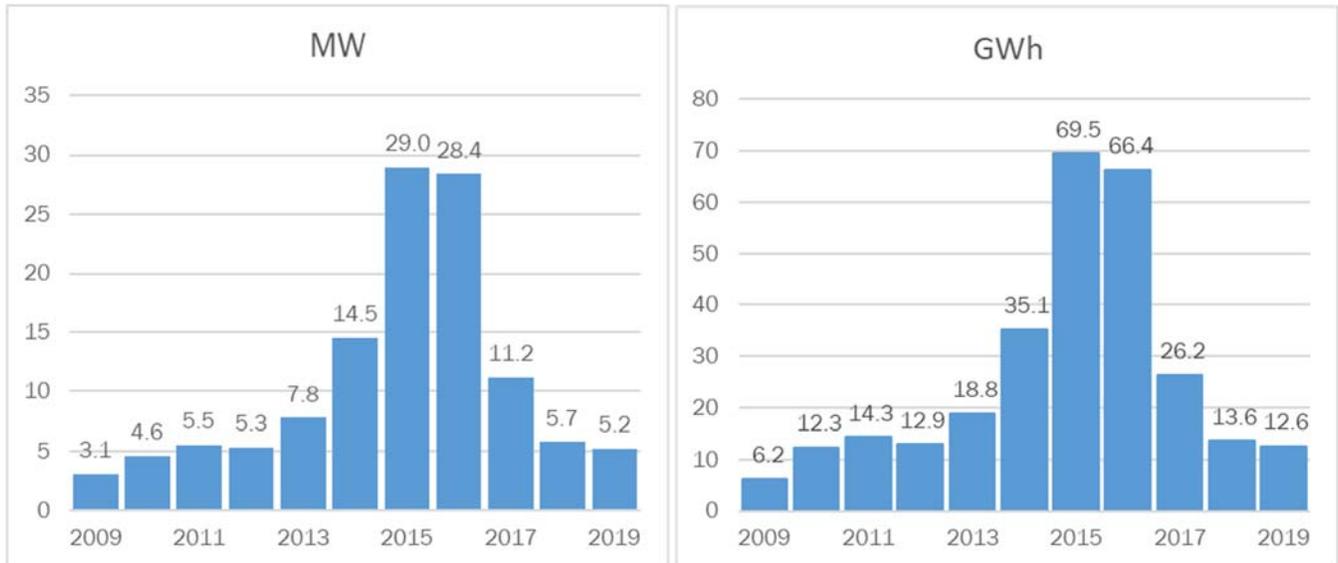
In 2019, PSEG Long Island continued to offer financing to residential and non-residential customers and rebates to low-income customers to promote the installation of solar photovoltaic (PV) systems. These offerings, along with the increased awareness and demand for solar in Long Island, served to encourage customer-sited electric generation, helping customers gain more control over their electric bills and reduce their carbon footprint while also offsetting PSEG Long Island's energy and capacity requirements. Beginning in 2014, PSEG Long Island facilitated the NYSERDA-funded NY-Sun Residential and Small Non-Residential initiative for Long Island customers. Up until 2018, the NY-Sun program had utilized an MW block structure that allotted successive tiers of rebate rates such that early adopters received the highest rebates. Rebates were offered for residential projects as large as 25 kW and for non-residential projects of up to 500 kW. The NY-Sun funding for these rebates is no longer available on Long Island as all MW blocks have been allotted. However, the program continued to accept applications for solar PV installations through financing offered by Green Jobs – Green New York throughout 2019. Applications were also accepted for installations in low-income households incentivized through Affordable Solar.

The Renewable Energy Portfolio greatly exceeded its goals in 2019, achieving verified ex ante savings of 229% of its goal for energy savings and 230% of its goal for demand savings. In 2019, PSEG Long Island supported rebates or financing for 633 solar PV systems, which is a 30% increase from 2018. The majority of the 2019 projects received financing through Green Jobs - Green New York (565), with the rest receiving rebates through Affordable Solar (99) or both rebates and financing (31). The increase in projects between 2018 and 2019 are primarily from an increase in financing projects (395 in 2018 versus 565 in 2019). It should be noted, however, the number of rebated systems and the energy and demand savings from the Renewable Energy Portfolio have dropped considerably in recent years, following the depletion of most NYSERDA funded rebates and the switch in compensation model from net metering to Value of Distributed Energy Resources model for non-residential systems. Many additional solar systems continue to be installed each year on Long Island without support of rebates reflecting the maturity of the market. Figure 4 outlines historical portfolio achievement of demand and energy savings for rebated and financed systems only.

¹⁰ Carbon dioxide equivalents includes carbon dioxide, methane, and nitrous oxide.

¹¹ Displacement savings values calculated using 2018 Long Island sub-regional emissions rates of the U.S. Environmental Protection Agency's (EPA's) Emissions & Generation Resource Integrated Database (eGRID 2018v2), released January 28, 2020. Equivalent savings values are based on the U.S. EPA's Greenhouse Gas Equivalencies Calculator (updated March 2020).

Figure 4. 2019 Renewable Energy Portfolio Evaluated Net MW and GWh Savings



2.5 Renewable Energy Portfolio Economic Impacts

The 2019 evaluation also includes an assessment of the economic impact of investments in the Renewable Energy Portfolio on the economy of Long Island. Opinion Dynamics developed an I-O model of the Long Island regional economy for the 2011 evaluation and updated the model inputs in each subsequent year. We estimated economic impacts associated with the PSEG Long Island’s 2019 investments, and then combined those results with our assessments of the prior 11 years of implementation of the Renewable Energy Portfolio programs to arrive at a portfolio-to-date estimate.

As shown in Table 4, our analysis of economic benefits found that PSEG Long Island’s \$2.3 million investment in the Renewable Energy Portfolio in 2019 returned and additional \$14.8 million in total economic benefits to the Long Island regional economy in 2019, including 84 FTEs. Over the 10-year period, these 2019 investments are expected to return \$18.8 million in total economic benefits to the regional economy (2019 dollars), with an employment benefit of 116 new FTEs.

Extrapolating these results over the 10-year life of the portfolio, the \$154.3 million investment in Renewable Energy programs to date (\$240.0 million in 2019 dollars) produced approximately \$538.3¹² million in cumulative annual economic benefits, with an employment benefit of 2,478 FTE employees. Over the 10 years following each program year investment, these 11 years of investments are expected to return approximately \$901.9¹³ million to the Long Island regional economy and result in 4,678 additional FTEs between 2009 and 2028.

¹² In 2019 dollars.

¹³ In 2019 dollars.

Table 4. Economic Impact of 2009–2019 Renewable Energy Portfolio Investments

Effect	Impact of 2019 Program Investment		Impact of 2009-2019 Program Investment	
	First-Year Impact	Impact over 10 Years ^a	First-Year Impact	Impact over 10 Years ^a
Total Economic Output (2019 \$1M) ^b	\$14.8	\$18.8	\$538.3	\$901.9
FTE Employees	84	116	2,478	4,678

^a Includes the 10-year impacts for each program year beginning in that year.

^b Total economic output is the value of industry production. In IMPLAN, these are annual production estimates in producer prices.

Similar to recent results, 2019 spending on PSEG Long Island’s Renewable Energy Portfolio resulted in greater benefits to the Long Island economy than in early program years. However economic impacts have declined since the peak in 2015, due to reduced funding availability through NYSERDA’s NY-Sun program. The renewables portfolio still realized positive economic impacts in 2019; however, with very little NY-Sun funds available, this results in lower overall economic output compared to its peak.

2.6 Key Themes for Continued Success

The Energy Efficiency and Renewable Energy Portfolios continued to demonstrate strong performance in 2019, providing substantial energy savings in a cost-effective manner. Combined, the portfolios exceeded the established goals for both energy and demand savings. In 2019, PSEG Long Island continued to offer new energy-saving measures and implemented new program designs. In addition, PSEG Long Island’s programs continue to diversify measure offerings and reduce the reliance on lighting savings. As the lighting market continues to transition, and with the ambitious New York state efficiency targets in place, identifying and investing in new and emerging solutions will be imperative to the portfolios’ long-term success.

New Efficiency: New York Order

Over the next several years, PSEG Long Island will likely face significant challenges in responding to ambitious energy efficiency and renewable energy initiatives in New York. As part of its overall goal of reducing GHG emissions by 40% by 2030, New York set a statewide energy efficiency target of 185 TBtu by 2025. A significant portion of this savings is expected to arise from accelerated energy efficiency investments by the state’s utilities. Beneficial electrification of thermal end uses in buildings is a key energy efficiency and decarbonization strategy that the utilities are expected to use to meet these goals. In laying out these targets, the New Efficiency: New York Order¹⁴ established MMBtu targets to spur beneficial electrification of buildings, including heat pumps. The Order further established a subsidiary target of an annual 3% reduction in electricity sales from electric utilities in 2025. PSEG Long Island adopted MMBtu savings goals in 2020, accounting for efficiency achievements in natural gas, fuel oil, propane, and other fossil fuels, in addition to electricity. Consistent with the New Efficiency: New York Order, PSEG Long Island is transitioning its portfolios from a singular goal of achieving electric savings to the dual goals of achieving both electric savings and fossil fuel savings via beneficial electrification. Aligning PSEG Long Island’s Energy Efficiency Portfolio with the MMBtu target, as well as the annual target for reduction in electricity sales, will require substantial changes to existing programs and additional energy efficiency investments. Cost-effectiveness must remain an important metric in determining the viability of energy efficiency measures and programs. Still, all energy efficiency benefits will need to be more carefully considered, including non-energy benefits, to ensure comprehensive and optimal energy efficiency investments. To maintain overall performance, and to build on the historical success of the

¹⁴ Case 18-M-0084, In the Matter of a Comprehensive Energy Efficiency Initiative, Order Adopting Accelerated Energy Efficiency Targets (issued December 13, 2018).

Energy Efficiency and Renewable Energy Portfolios, PSEG Long Island must continue to identify and consider emerging issues and challenges during its planning, budgeting, implementation, and management decisions.

COVID-19 Pandemic

The COVID-19 pandemic has posed substantial challenges to energy efficiency portfolios nationwide. The pandemic's impacts, however, vary considerably among the U.S. utility efficiency programs. With New York being particularly hard hit and experiencing some of the earliest and most comprehensive stay-at-home orders, the New York program administrators have faced unique and larger challenges than their counterparts in other parts of the nation. In March, PSEG Long Island paused all residential and commercial onsite work and is only now beginning to restart these activities in June.

The resumption of PSEG Long Island's program activities will necessarily require a measured approach in parallel with the state's phased reopening. Programs requiring activities at customer's homes and businesses are now developing and implementing guidelines and protocols for site work aimed to ensure the health and safety of both customers and workers. These changes will take time to implement and will require additional investments by program administrators and implementers. The unforeseen events of 2020, the three-month pause for some programs, the incremental restart of certain program activities, and a sustained economic downturn, will likely have implications for PSEG Long Island's energy efficiency program savings and budgets.

The longer-term effects of the pandemic on the economy, energy use patterns, and customer demand for efficiency are uncertain. Long-range plans made prior to the pandemic will certainly need to be reviewed and revised as the picture does become clearer. In the short term, program administrators must reimagine how to effectively deliver energy efficiency services and serve more people in this new environment (e.g., through additional remote and low/no touch processes). As the economy gradually reopens, certain segments of the commercial and residential sectors will look to engage with PSEG Long Island's efficiency programs before others. For example, recent market research in New York indicates that many residential customers are initiating home improvement projects, which could provide opportunities for residential energy efficiency programs. Also, some energy efficiency program administrators are reporting increases in online marketplace activity that are offsetting declines in participation in other programs. PSEG Long Island should continue to monitor the efficiency market opportunities on Long Island, engage with trade allies, customers, and other stakeholders, and be prepared to adjust program offerings and outreach as opportunities arise.

Below we provide an overview of the performance of the Energy Efficiency and Renewable Energy Portfolios for the 2019 evaluation cycle and identify challenges that warrant attention in the future.

2.6.1 Energy Efficiency Portfolio

Commercial Efficiency Program

Overview of Performance

PSEG Long Island's CEP continued to offer Long Island's commercial customers effective opportunities for energy savings through the Comprehensive Lighting, Fast Track Lighting, HVAC, Standard, and Custom program offerings. The 2019 CEP also continued to offer no-cost energy assessments, cost-shared technical assistance studies, building commissioning co-funding, Leadership in Energy and Environmental Design (LEED) certification incentives, and ENERGY STAR® Benchmarking certification.

The CEP's performance was mixed in 2019. The evaluated (ex post) energy savings for the program were just below the goal (99%). Ex post demand savings were also below the goal (89%). The CEP performed well in

other areas as it continued customer and trade ally engagement, rigorous data tracking and quality assurance/quality control, exploration of alternative savings sources, and improvements to the program participation process. Highlights contributing to the program's performance include:

- 2019 was the first full program year since the CEP began offering performance-based incentives for Comprehensive Lighting projects. Comprehensive Lighting rebates changed from being calculated on a per-fixture basis to being calculated on a per-kWh basis, based on the energy savings a measure generates. This shift better aligns rebates with the claimable savings a project generates, as rebates are directly related to the level of inefficiency of the replaced equipment and the expected operating hours of the facility. By aligning the incentives, the CEP is encouraging more efficient installations and CEP administrators can better align budgets and energy savings goals over the course of a program year.
- The CEP administrators sought to expand the array of measures offered in 2019. While lighting measures still accounted for the largest share of the CEP's evaluated energy savings in 2019 (77%), the share of savings from lighting continued to decrease as it has each year in the past several years. In 2019, the CEP placed greater emphasis on refrigeration measures, developing a standalone refrigeration rebate application promoting a variety of measures.

Potential Challenges for the Future

While the CEP's heavy reliance on lighting will continue to be a challenge for PSEG Long Island as the lighting market transforms, the addition of new measures and changes to incentive structures in 2019 mark positive movement toward more measure diversity. Additional new non-lighting measures are also being introduced in 2020 (e.g., lawn care equipment, non-road EVs, pool equipment). Also, in 2020, to promote new emerging measures, the CEP developed a custom program app, which offers performance-based rebates on custom measures. As noted in previous evaluations, PSEG Long Island should continue to monitor the rapidly changing commercial LED lighting market and adjust rebate levels and caps where possible, and also continue to explore new offerings and emerging technologies.

As described above, to meet new ambitious energy savings goals, it is anticipated that building electrification will become an important aspect of both commercial and residential programs going forward. The MMBtu targets will affect how PSEG Long Island delivers all of its programs, including the CEP. Additional investments in commercial building space heating and cooling technologies, such as air source heat pumps, geothermal heat pumps, and variable refrigerant flow systems, will begin to play a significant role in addressing the New Efficiency: New York targets.

Residential Efficiency Programs

Overview of Performance

Together, the residential programs provided about two-thirds of the Energy Efficiency Portfolio's energy savings in 2019. Based on ex post savings, the residential programs exceeded their energy and demand savings goals by 18% and 15%, respectively. This performance was largely driven by the EEP program, which accounts for about 82% of the savings from the residential programs. Based on evaluated savings, the EEP program exceeded its energy savings goal by 32% and its demand savings goal by 23%; much of this was due to a higher number of standard LEDs rebated in 2019: more than two million compared to the plan of one million.

The HEM program, which accounts for the next largest portion of residential program savings, saw a considerable decrease in savings in 2019. Evaluated energy savings were about half that realized in 2018 and about 76% of the program's goal. Overall, the percent savings on a per household level decreased from

1.06% in 2018 to 0.7% in 2019. While the 2019 savings are in the range of similar programs across many other jurisdictions (including elsewhere in New York), some of the reduction in savings from 2018 may be resulting from changes in the frequency and timing of home energy reports. In 2019, a significant portion of participants received fewer reports in the summer when savings opportunities are generally higher due to a reduction in actual meter reads as meter reading routes were altered.

The remainder of the residential portfolio—Home Comfort, REAP, and Home Performance programs—accounted for just 3.5% of the residential programs' energy savings. The Home Comfort program also exceeded its energy savings goal in 2019, while the REAP and the Home Performance programs fell short. Notably, in 2019 the Home Performance with Energy Star program achieved 4,114 MMBtu of energy savings from beneficial electrification measures.

Potential Challenges for the Future

PSEG Long Island will need to continue to monitor emerging technologies and invest in new offerings to address the rapidly changing markets for energy-efficient products. While the delayed implementation and enforcement of EISA lighting rules have resulted in the regional acceptance of continued investment in standard LED lighting via upstream lighting programs to increase customer adoption of LED lighting in the short term, this market is generally viewed as transforming to LEDs as the market baseline with or without the federal standards. With the price premium for efficient lighting diminishing, going forward the programs will have a diminishing ability to influence the lighting purchasing behaviors of residential customers through rebates. Program staff will need to plan carefully and set appropriate goals that are consistent with this transforming market.

To meet the ambitious New York energy savings goals for 2025, building electrification is necessarily becoming an important aspect of PSEG Long Island's residential programs. To meet the New Efficiency: New York Order calling for high rates of high-efficiency heat pump adoption and fuel-neutral deep energy retrofits, the residential programs, and in particular the Home Comfort program, will need to focus resources not only on appropriate equipment rebates but also on marketing, education and outreach to increase awareness and reduce other barriers to the adoption of these newer unfamiliar technologies.

2.6.2 Renewable Energy Portfolio

Solar Photovoltaic Program

Overview of Performance

PSEG Long Island's Solar PV program performed well in 2019 in relation to its goals. The program's verified ex ante savings reached 229% of the energy savings goal and 230% of the peak demand goal. The ex post savings were similarly more than double the goals at 211% and 215% of the energy and demands savings goals, respectively.

In terms of the overall number of systems rebated and installed capacity, however, the solar PV program is greatly reduced from prior years. PSEG Long Island supported rebates or financing for just 633 solar PV systems in 2019. While this is an increase of 30% from the number of projects completed in 2018, it is just 9% of those completed in 2015. This decline corresponds with the depletion of NYSERDA-funded rebates for residential systems (in April 2016) and non-residential systems (in February 2019). The majority of the residential systems (508) in 2019 were projects receiving loans through the On-Bill Recovery Financing Program offered by Green Jobs – Green New York and rebates through the Affordable Solar program. Only 53 non-residential systems received rebates through the Solar PV program in 2019 before the non-residential

NYSERDA rebates for Long Island were depleted. Transitioning from the net metering compensation model to the VDER model for non-residential systems has also resulted in fewer non-residential solar interconnections. The VDER compensation model, which initially applied to all new non-residential projects submitted after May 1, 2018, takes into account the temporal and locational value of electricity sold to the grid. Program administrators estimate that the "all-in" value of compensation for most commercial customers under VDER is roughly two-thirds of what they would have received under a net metering model.¹⁵ To spur more non-residential interconnections, in late Fall of 2019, the compensation mechanism began to allow net metering for non-residential projects of 750 kW or lower. As a result, Long Island has seen an increase in non-residential solar interconnections in 2020.

In 2019, PSEG Long Island began promoting energy storage using modified Dynamic Load Management tariffs as the implementation mechanism. In addition, the New York State Energy Storage Roadmap provided \$55 million in rebates for battery storage. Of this, \$25 million has already been allocated - \$5 million for residential behind the meter, \$10 million for non-residential behind the meter, and \$10 million for utility-scale battery storage. Rebates for residential energy storage were offered only in conjunction with a new solar PV installation while non-residential customers received support for energy storage with or without an associated solar PV installation. According to program administrators, about 190 residential and a small number of non-residential interconnection applications for battery storage systems were received in January 2019. The program achieved its aim of 90 interconnections for 2019 and is on course to achieve the 240 interconnections aimed for 2020.

Past research conducted by the evaluation team credited PSEG Long Island's legacy Solar Pioneer and Solar Entrepreneur programs with promoting the development of a renewable energy industry on Long Island, helping increase consumer awareness of and demand for solar energy while also contributing to a robust supply chain and delivery infrastructure. This healthy solar market on Long Island continues to exhibit a high demand for solar PV even without incentives or financing from PSEG Long Island. Program administrators note that PSEG Long Island approves approximately 600 applications per month for solar interconnection.

Potential Challenges for the Future

By design, the NY-Sun program is winding down on Long Island: As of April 2016, PSEG Long Island had allocated all of the 149 MW of residential solar PV funding and, as of February 2019, all of the 84 MW of non-residential funding had been allocated. PSEG Long Island still provides On-Bill Recovery Financing Program through Green Jobs – Green New York, and some funding is available for residential income-qualified customers through the Affordable Solar incentives program. However, without the NYSERDA rebates, direct impacts of the PSEG Long Island Solar PV program will continue at the lower levels seen in recent years. However, market and policy forces are likely to continue to advance solar PV on Long Island and statewide over the longer term. In the short term, however, there is some uncertainty that PSEG Long Island will need to monitor. For example, it remains to be seen what role PSEG Long Island will play in the governor's goal of installing six gigawatts of distributed solar in New York by 2025. In addition, PSEG Long Island is introducing new time-of-use rates in 2021, which are expected to spur further adoption of solar PV with battery storage.

¹⁵ According to NYSERDA, compensation under VDER will vary by project, but "in many cases, compensation will be lower under the value stack than under [net metering]." (<https://www.nyserdan.ny.gov/-/media/NYSun/files/VDER-Frequently-Asked-Questions.pdf>)

3. Impact Results

This section presents the evaluated gross energy and demand impacts for the Energy Efficiency and Renewable Energy Portfolios.

3.1 Energy Efficiency Portfolio Impacts

The portfolio of Energy Efficiency programs performed well in 2019, delivering considerable energy savings to electric customers on Long Island. The portfolio's verified ex ante gross energy and demand savings, which are used for determining if PSEG Long Island achieves its annual scorecard goals, came in above the stated energy and demand savings goals. Specifically, the Energy Efficiency Portfolio accounted for 328,811 MWh and 63.94 MW of verified ex ante savings for 2019. This represents 120% of gross energy and 110% gross demand savings compared to goals, as shown in Table 5. The ex post gross energy savings and demand savings were 111% and 107% of the goals, respectively.

Table 5. Gross Impacts: Energy Efficiency Portfolio Ex Post and Verified Ex Ante Savings Versus Goals

Program	2019 Gross Savings Goals		Verified Ex Ante Gross Savings				2019 Ex Post Gross Savings			
	MWh	MW	MWh	% Goal	MW	% Goal	MWh	% Goal	MW	% Goal
Commercial Efficiency Program	95,953	19.78	97,743	102%	17.81	90%	94,983	99%	17.65	89%
Residential Efficiency Programs										
Energy Efficient Products	130,599	34.08	159,809	122%	42.95	126%	172,583	132%	42.05	123%
Home Comfort	2,728	1.81	3,472	127%	1.17	65%	3,578	131%	1.02	56%
Residential Energy Affordability Partnership	1,472	0.32	1,472	100%	0.36	112%	1,219	83%	0.29	90%
Home Performance	2,761	2.19	2,300	83%	1.65	76%	2,743	99%	0.96	44%
Home Energy Management	41,487	NA	64,015	154%	N/A	N/A	31,405	76%	NA	N/A
Subtotal Residential	179,047	38.40	231,068	129%	46.13	120%	211,528	118%	44.32	115%
Total Energy Efficiency Portfolio	275,000	58.18	328,811	120%	63.94	110%	306,511	111%	61.96	107%

The CEP accounted for about 31% of the Energy Efficiency Portfolio ex post energy savings in 2019. The CEP achieved verified ex ante savings of 102% of its 2019 gross energy savings goal and 90% of its gross demand goal, and ex post savings of 99% and 89% of its energy and demand savings goals, respectively. Residential programs' performance varied by program. Overall, residential programs achieved verified ex ante savings of 129% of energy and 120% of demand savings goals; and ex post savings of 118% of energy and 115% of

demand savings goals. The energy savings performance was largely driven by the EEP program, which accounted for 82% of residential energy savings and, therefore, had a substantial impact on the ability of the portfolio to achieve savings goals. For additional detail about the sources of energy savings from these programs, see Section 2.6.1 and the Volume II – Program Guidance Document.

3.2 Renewable Energy Portfolio Impacts

In 2019, the Renewable Energy Portfolio's verified ex ante savings exceeded the gross energy and demand generation goals by 229% and 230%, respectively, and ex post energy and demand savings by 211% and 215%, as shown in Table 6.

Table 6. Gross Impacts: Renewable Energy Portfolio Evaluated and Verified Ex Ante Savings Versus Goals

Program	2019 Gross Savings Goals		Verified Ex Ante Gross Savings				2019 Evaluated Gross Savings			
	MWh	MW	MWh	% Goal	MW	% Goal	MWh	% Goal	MW	% Goal
Solar PV	5,596	2.2	12,814	229%	5.05	230%	11,825	211%	4.72	215%
Total Renewable Energy Portfolio	5,596	2.2	12,814	229%	5.05	230%	11,825	211%	4.72	215%

Appendix A. Glossary of Terms

BTU	British Thermal Unit
CEP	Commercial Efficiency Program
CF	Coincidence Factor
CHP	Combined Heat and Power
EEP	Energy Efficiency Products
EISA	Energy Independence and Security Act
EPA	U.S. Environmental Protection Agency
FR	Free Ridership
HEM	Home Energy Management
kW	Kilowatt
kWh	Kilowatt Hour
LED	Light-Emitting Diode
LEED	Leadership in Energy and Environmental Design
LIPA	Long Island Power Authority
NEB	Non-Energy Benefit
NTGR	Net-to-Gross Ratio
NYSERDA	New York State Energy Research and Development Authority
PV	Photovoltaic
REAP	Residential Energy Affordability Partnership
REV	Reforming the Energy Vision
SCT	Societal Cost Test
SO	Spillover
UCT	Utility Cost Test
VDER	Value of Distributed Energy Resources
VEA	Verified Ex Ante

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